Nature Conservation 28: 1–32 (2018)
doi: 10.3897/natureconservation.28.25067
http://natureconservation.pensoft.net

REVIEW ARTICLE

A peer-reviewed open-access journal
Nature Conservation
Launched to accelerate biodiversity conservation

What is biological cultural heritage and why should we care about it? An example from Swedish rural landscapes and forests

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Academic editor: *Y. Haila* | Received 15 March 2018 | Accepted 11 June 2018 | Published 5 July 2018

http://zoobank.org/39A2EA4B-6FD0-449E-BD57-83DAF18E7BD8

Citation: Eriksson O (2018) What is biological cultural heritage and why should we care about it? An example from Swedish rural landscapes and forests. Nature Conservation 28: 1–32. https://doi.org/10.3897/natureconservation.28.25067

Abstract

There is currently a growing concern that biocultural heritage is threatened in many landscapes. This paper focuses on biological cultural heritage, broadly meaning biological cultural traces that are considered as heritage, but leaving out other aspects of the biocultural heritage concept. An operational definition of biological cultural heritage (BCH) is suggested, based on niche construction theory: "biological manifestations of culture, reflecting indirect or intentional effects, or domesticated landscapes, resulting from historical human niche construction". Some factors that influence recognition of BCH are discussed, using a comparison between Swedish open to semi-open vs. forested landscapes. While the former landscapes are generally associated with biological cultural values, BCH is generally over-looked in forests. Two main reasons for this are suggested: loss of cultural memory and a perception of forests as wilderness. A conclusion is that recognition of BCH is essential for guiding development of biological conservation programmes in forests, irrespective of whether the conservation goal is to focus on culturally impacted forests or to conserve what is considered as close to pristine forests. Furthermore, recognising BCH in forests will promote interest and learning of the history of forests and their values and will be informative for developing conservation programmes for all biota in forests, not only those that historically were favoured by culture. Hence, there is no inherent conflict between preserving relatively untouched forests and those with remaining traces of pre-industrial forest management. The recognition of BCH in forests will inspire and promote further integration of cultural and natural heritage research.

Keywords

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Conservation biology, Domesticated landscapes, Niche construction, Semi-natural grasslands, Wilderness, Wood pastures

Introduction

There is currently a growing interest in conservation of cultural landscapes, motivated by a concern that values associated with these landscapes are eroding (e.g. Rössler 2006, Harrop 2007, UNESCO 2008, 2014, Agnoletti and Rotherham 2015). Cultural landscapes represent relationships amongst people, events and places through time (Taylor and Lennon 2011). They are "combined works of nature and man" (UNESCO 1972, Article 1) or, as stated in the European Landscape Convention (Council of Europe 2000), "an area as perceived by people whose character is the result of the action and interaction of natural and/or human factors". A concept that has attracted a lot of attention in this context is biocultural diversity and heritage incorporating and integrating both cultural and biological (and abiotic) aspects of landscapes (e.g. Pretty et al. 2009, Gavin et al. 2015, Rotherham 2015, Bridgewater 2017).

Biocultural diversity refers to the interface and relationship between biological and cultural diversity (e.g. Maffi 2005, Agnoletti and Rotherham 2015, Lennartsson et al. 2018). Although there are other related concepts, for example "ecodiversity" (Naveh 1998) and "ethnobiology" (Wolverton et al. 2014), biocultural diversity has become dominating in the discourse linking different aspects of cultural diversity with use of natural resources and for identifying how these links promote and maintain both cultural and biological diversity (Lennartsson et al. 2018).

Biocultural heritage is defined by UNESCO (2008, page 8) as "living organisms or habitats whose present features are due to cultural action in time and place". Cultural landscapes across the world, considered as outstanding, are protected under the UNESCO World Heritage Convention, particularly focusing on (i) clearly defined landscapes designed and created intentionally by humans, (ii) organically evolved landscapes, such as agricultural landscapes and (iii) associative cultural landscapes, e.g. religious and sacred landscapes (Rössler 2006, pages 335-336). UNESCO (2008, page 9) recognises several "areas of interdependencies" between biological and cultural diversity, thus forming the basis of biocultural heritage: language and linguistic diversity, material culture, knowledge and technology, modes of subsistence (which includes land use), economic relations, social relations and belief systems.

Biocultural heritage is often associated with indigenous people (e.g. Maffi 2005, Pretty et al. 2009, Wolverton et al. 2014, Gavin et al. 2015) and local rural communities (e.g. Galluzzi et al. 2010, Dahlström et al. 2013, Otero et al. 2013, Agnoletti et al. 2015, Cohen et al. 2015, Vallejo et al. 2015, Rangel-Landa et al. 2016). However, some authors suggest that the concept should be applied more broadly, for example, as expressed by Cocks and Wiersum (2014, pages 733–734) that biocultural heritage "…should be extended to include the values and associated practices concerning biodiversity of any

kind of either traditional/rural or modernized/urban societies." This view is expressed also in the European Landscape Convention (Council of Europe 2000) which recognises "landscapes that may be considered outstanding as well as every-day and degraded landscapes". Furthermore, biocultural heritage usually reflects something "old and traditional". However, although the material basis of what is considered heritage often has deep historical roots, the meaning and value people assign to material manifestations of culture are considered constantly changing and renegotiated in the current society (e.g. Hobsbawn 1983, Smith 2006, Tilley 2006, Graham and Howard 2008, Storm 2008, del Mármol and Vaccaro 2015, Braaksma et al. 2016, Stenseke 2016). This also holds for biological manifestations of heritage, for example, features of species, species distributions or vegetation patterns, understood as having originated or having been favoured historically, e.g. by past management regimes. Furthermore, as biological manifestations of cultural history are living, they may survive, unchanged or transformed, although the historical cultural context where they originated has vanished (Eriksson 2016).

Given these considerations, there is a need for discussing and clarifying what kind of biological features that are recognised as heritage. At first, we should recognise that human impacts always leave biological traces. This is unavoidable and ubiquitous. Some of them are highly valued and some are not, because they are not recognised or because they are considered as degraded nature, uninteresting or ugly. Henceforth in this paper, a distinction is made, using the term "biological cultural heritage" as broadly meaning biological cultural traces (species, vegetation etc.) that are considered as heritage, but leaving out other aspects of culture (e.g. language, religion etc.) that are also part of the biocultural heritage concept.

The objectives of this paper are twofold. Firstly, an operational definition of the concept biological cultural heritage is suggested. Secondly, some factors that influence how biological cultural heritage is identified and perceived are discussed, using a comparison between two components of rural landscapes in Sweden: (i) open and semi-open landscapes with remains of (what are viewed as) traditionally managed semi-natural grasslands and (ii) forested landscapes. The rationale for this choice of landscape components is that open rural landscapes are generally associated with cultural values, whereas forests largely have become excluded from being seen as harbouring values related to cultural heritage. The objective is to try answering the question why this is so and thereby identifying some of the challenges associated with assigning biological features as heritage.

Biological Cultural Heritage – a suggested definition

Biological cultural heritage (henceforth BCH) has been defined as: "…ecosystems, habitats and species which have originated, developed or been favored by human utilization of the landscape and whose long-term persistence and development is dependent on, or favored by management." (Swedish National Heritage Board 2014). This definition is similar to, but more specific than the UNESCO (2008) definition of

biocultural heritage as "living organisms or habitats whose present features are due to cultural action in time and place", the latter leaving out any reference to long-term persistence. Both these definitions are rather broad and avoid any specification of the time-depth of the origin of the cultural actions, i.e. the human utilisation of the landscapes. Even features such as a clear-cutting in a production forest would be BCH according to these definitions.

Human cultural impacts always leave biological traces. A starting point is asking what kinds of biological cultural traces there are. I suggest we can recognise three levels of biological cultural traces, distinguished by an increasing magnitude of interaction with culture through history.

The first level is indirect effects of human actions. All kinds of human activities influence other species indirectly, by favouring some species, for example, by creating suitable habitats for them or by disfavouring some species, for example, by destroying their habitats. This is trivial, but may not preclude interesting biological legacies from human history. In a study of bracken (*Pteridium aquilinum*) in Finland, Oinonen (1967a) associated clones of different size with various war episodes going back to the 14th century. One example was an unusually large bracken clone, which Oinonen suggested was spatially associated with the raiding of a stronghold close to the present-day city of Turku in the year 1318. The proposed mechanism behind this and other examples of spatial associations between bracken clones and war episodes is that war promotes fires and fires promote recruitment of bracken. Of course, it was not the intention of the war episodes to promote bracken. However, given that we have some knowledge of the association between bracken clones and Finnish war history at the specific sites, we may regard these bracken clones as BCH.

The second level is biological cultural traces that reflect human intentionality affecting single species or groups of species. For example, Rotherham (2007) mentions what he calls botanical indicators of antiquity and disturbance, such as "working trees". For example, in former wooded meadows, trees bear signs of earlier pollarding and coppicing (e.g. Hæggström 1992, 1998, Hartel et al. 2015). Other examples of biological cultural traces reflecting human intention are remnants of fruit trees or other plantations close to no longer existing farms and cottages (e.g. Gunnarsson 2010, Karlsson Strese et al. 2014). We may regard all these biological cultural traces as BCH.

Note that the second level partly incorporates the first level. Human intentionality, for example, in creating a garden or a wooded meadow, unavoidably implies indirect effects for other species. For example, the exceptional species richness of semi-natural grasslands such as wooded meadows with a long management history (Wilson et al. 2012, Eriksson and Cousins 2014) reflects both intentionality and indirect effects. We may regard the patterns of species composition and diversity, *per se*, in these former meadows, as BCH.

The third level is when the biological cultural traces are the result of long-term reciprocal interactions between culture and the biological communities that serve as a basis for the culture. These interactions create what has been called domesticated landscapes, broadly meaning whole landscapes transformed by humans to support society,

but also affecting many other species (e.g. Terrell et al. 2003, Erickson 2006, Kareiva et al. 2007, Widgren 2012, Eriksson et al. 2018). Domesticated landscapes can be seen as the result of niche construction, a process whereby organisms, through their activities, modify their own and other species' niches (Odling-Smee et al. 2003). When humans are involved in a niche construction process, culture becomes one of the key factors (Kendal et al. 2011), creating a cultural niche (Laland and O'Brien 2012). Theory of human niche construction has been productive in understanding many features of human management and land-use, for example, global species distributions (e.g. Boivin et al. 2016), domestication of plants and animals (e.g. Smith 2016), development of infields (Eriksson and Arnell 2017) and for understanding the present anthropogenic biosphere in general (Ellis 2015).

Incorporating domesticated landscapes resulting from niche construction in a definition of BCH specifically stresses that biological cultural traces have or have had (previously during history) a great importance and meaning for people. Domesticated landscapes also relate to what has been termed "sociotechnical transition pathways" (Geels and Schot 2007). Furthermore, over time and due to the reciprocal interactions between culture and biological communities, both cultural and biological features have developed and changed. For example, management practices change over time, in response to and influencing the structure and composition of biological communities. What characterises this third level, domesticated landscapes, is that it encapsulates a "wholeness" of the environment influenced by and influencing human society. As such, it partly incorporates the previous two levels. Domesticated landscapes derived from niche construction processes include intentionality and unintended indirect effects on various species.

I thus propose the following definition of Biological Cultural Heritage (BCH): biological manifestations of culture, reflecting indirect or intentional effects or domesticated landscapes, resulting from historical human niche construction (Figure 1).

However, we need to clarify a critical question related to the definition. Heritage is not a value-neutral concept. As mentioned above, the meaning and value people assign to material manifestations of culture may change over time (e.g. Smith 2006, Graham and Howard 2008, Storm 2008, Braaksma et al. 2016) and cultural heritage generally has a positive connotation. A question is what makes BCH recognised and thus valued in a society?

There is extensive literature concerned with people's valuation of biological features and objects in landscapes. To cover this vast literature would be far beyond the scope of this paper, but it is nevertheless possible to identify some generalities. There are two main approaches to understand people's valuation and appreciation of biological features of landscapes: that preferences are culturally derived and biased or that they have an evolutionary basis (Fry et al. 2009). An example of the latter is the so called "savanna hypothesis", suggesting that humans have an innate preference for resource-rich, semi-open landscapes, with access to water bodies (Orians and Heerwagen 1992). For the purpose of this paper however, I leave this latter possibility out and henceforth focus on preferences reflecting culturally derived values.

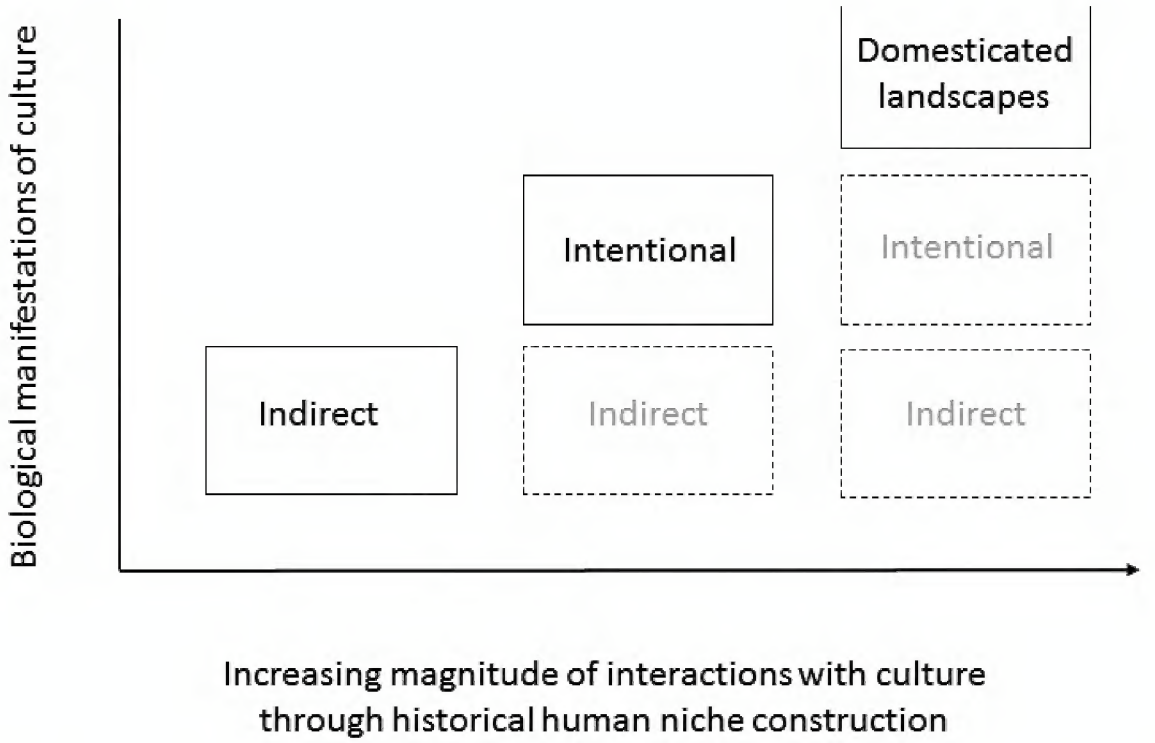

Figure 1. Biological cultural heritage defined as biological manifestations of culture, reflecting indirect or intentional effects or domesticated landscapes, resulting from historical human niche construction.

Generally, it is acknowledged that aspects such as landscape beauty, knowledge and memory of landscape history are important factors in valuation of landscapes (e.g. Schama 1995, Olick and Robbins 1998, Fairclough and Herring 2016). Herrington (2016) remarked that there has been a renewed interest in the concept of beauty during the last decades, in discourses on art, philosophy and landscape research. For landscapes, Herrington (2016, page 447) proposed that the most important aspects of beauty are "…contextual beauty and (…) functional beauty (which) both ask us to include the landscape's functional role in deeming a landscape beautiful." There is empirical support for this proposition when applied to landscapes (e.g. Vallejo et al. 2015, Dalglish and Leslie 2016). A possibility (so far very little studied) is that aesthetic preferences develop as a reciprocal interaction between humans and the physical, biological and cultural environments, an aesthetic niche construction process (Portera 2016). Furthermore, as remarked by Antrop (2005, page 21): "…the ability to tell a history of a place strongly enhances the identity and the overall value". This assumes that knowledge of landscape history and a "cultural memory" still exists. Potentially, landscapes may harbour biological (or other material) cultural traces that are not regarded as heritage, simply because of a loss of cultural memory (e.g. Rotherham 2007) or "cultural severance" (Rotherham 2013). An active and living knowledge and cultural memory relates to the current use of landscapes. This reflects the fact that the meaning and value people assign to material manifestations of culture relate to the extent people actually live on and work with the landscape (Buijs et al. 2006, Lindborg et al. 2009, Braaksma et al. 2016). This in turn reflects the importance of involvement of people when assessing values of landscapes and landscape features (e.g. Stenseke 2009, Svensson 2009, Dalglish and Leslie 2016).

These aspects of heritage may relate to both intangible and tangible values, in various ways linked to perceptions of continuity, private and public memories, identity

and a sense of place (Taylor and Lennon 2011). The possibly strongest perception of heritage is when natural sites are regarded as sacred (e.g. Dudley et al. 2009, Allendorf et al. 2014, Jackson and Ormsby 2017).

Thus, in order to be recognised as biological cultural heritage (Figure 1), the following criteria should be fulfilled: (1) The biological cultural trace reflects either a previous (historical) human impact or a current impact which is rooted in what is currently considered as a tradition (whether "invented", *sensu* Hobsbawn (1983) or not). A time-depth, a history, is essential. (2) If the biological cultural trace no longer has a function or role, knowledge of its previous function or role is essential. (3) It is essential that the biological cultural trace evokes feelings, either due to its role for people's identity and sense of place or for its sanctity or sheer beauty.

An example: Swedish rural agricultural landscapes and forests

Background

"*Before the industrialization of agriculture, only rarely did one run a farm or raise cattle without the support of a forest.*" (Agnoletti and Santoro 2015, page 440)

The second objective of this paper was to compare BCH in two different components of rural landscapes in Sweden: (i) open and semi-open pastures and meadows and (ii) forests. As the above quote from Agnoletti and Santoro (2015) suggests, agriculture historically utilised open land, crop fields, pastures and meadows and forests. Today, these two kinds of landscape components are viewed differently when it comes to recognising and valuing biological features in the context of culture and history (Figure 2). The rationale for making this comparison here is thus that it serves to illustrate some of the problems and challenges associated with recognising BCH.

In the southern parts of Sweden, large-scale landscape transformations due to agriculture had previously commenced during the Neolithic (from ca. 3900 BCE, Welinder 2011) and continued and expanded during the Bronze and Iron Ages (Pedersen and Widgren 2011). Many agricultural areas still comprise cultural landscapes with a long uninterrupted history of human management (e.g. Berglund 1991, Eriksson and Cousins 2014). The deep historical roots of open and semi-open grassland dominated landscapes are well known, as well as in a broader European context (e.g. Odgaard and Rasmussen 2000, Berglund et al. 2008, Emanuelsson 2009, Poschlod and Baumann 2010, Eriksson 2013, Kuneš et al. 2015). These grasslands are highly valued for their biodiversity and receive considerable subsidies to maintain management by grazing or mowing (e.g. Veen et al. 2009, Council of Europe 2017). The importance of a long previous historical management for this biodiversity has been documented in several studies (e.g. Cousins and Eriksson 2002, Lindborg and Eriksson 2004, Helm et al. 2006, Gustavsson et al. 2007). The perception of these landscapes as BCH is uncontroversial (Figure 3) and holds for both nature conservation authorities, as well as for

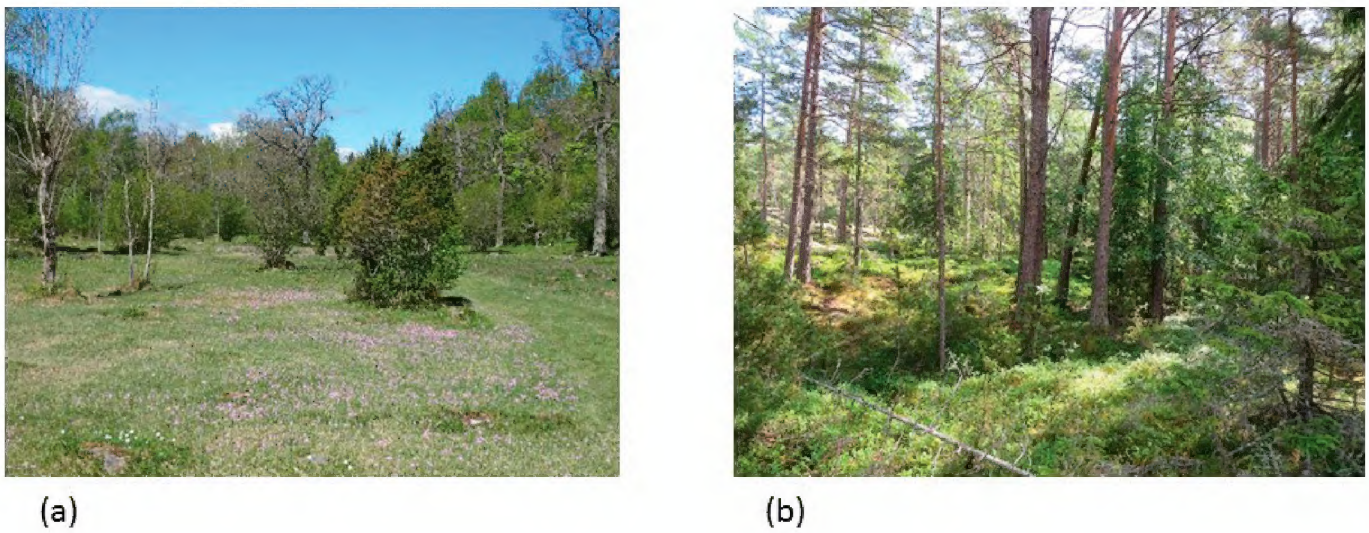

Figure 2. While remains of old agricultural management such as wooded meadows are viewed as cultural landscapes, forests usually are not. **a** Wooded meadow at Häverö parish, north of Stockholm, Sweden **b** Formerly grazed forest at Singö, north of Stockholm, Sweden. Photo: Ove Eriksson.

Figure 3. Biological cultural heritage may refer to a site where historical management has created species-rich grasslands, as well as to single species. **a** A semi-natural grassland at the Natura 2000 site of Stora Åsa, Province of Södermanland, Sweden. **b** *Succisa pratensis*, a species characteristic for these grasslands and which remains as legacy in forests long after management has ceased (Herben et al. 2006). Photo: Ove Eriksson.

people in general (e.g. Ihse and Lindahl 2000, Stenseke 2006, Lindborg et al. 2009, Eriksson and Cousins 2014, Eriksson 2016, Anonymous 2017a).

This is in stark contrast to how forests are perceived, not only in Sweden, but throughout Europe. As remarked by several authors (e.g. Rotherham 2007, 2015, Agnoletti and Santoro 2015), conservation biologists, ecologist and foresters often fail to appreciate forests as cultural landscapes. As succinctly stated by Agnoletti and Santoro (2015, pages 438-439): for forests there is a "widespread application of an idea of 'naturalness' (…) informed by the 'degradation' paradigm, emphasizing the negative role of man". Steen (1958) summarised the debate on forest grazing in Sweden during the early 20th century and despite recognising that forest grazing historically has

promoted species richness in forests, he presented an overly negative view on forest grazing, mainly from a forestry perspective (see also Kardell 2016). This perspective is still dominant. For example, "During the 18th and 19th centuries, many forests were heavily over-exploited for farming, housing construction, wood for fuel, charcoal for the iron industry (...) Cattle grazed the forests hampering tree regeneration." (Swedish Forest Agency 2015). Clearly, the basic attitude is that human impacts before modern forestry were degrading forests. To clarify, it may well be correct that forest grazing truly hampers forest production. My point concerns how forests are valued from a cultural and historical perspective. I am unaware of any authority claiming that, for example, historical hay-making in wooded meadows degraded these systems and this is irrespective of whether one may truly regard wooded meadows as degraded former deciduous forests. Accordingly, in many forested ecosystems, conservation programmes focus on recreating natural disturbance regimes with the goal to maintain or restore wilderness, overlooking and downgrading historical cultural impact of humans (e.g. Holl and Smith 2007, Svensson 2009, Olwig 2016). Furthermore, they often wrongly interpret culturally impacted forests as untouched (e.g. Willis et al. 2004, Josefsson et al. 2009, Latałowa et al. 2015).

Some may claim that the paragraph above is like attacking a straw man. For example, cultural heritage is indeed mentioned briefly in the Swedish Environmental Objective for Sustainable Forests (Anonymous 2017a). In the instructions for surveys of forest key biotopes, culturally influenced biotopes are included (Swedish Forest Agency 2014). However, they only appear under a special sub-heading ("Biotopes formed by management"), distinguished from coniferous, deciduous and wet forests, which then, by implication, are not formed by cultural impact. In a recent report from the European Academies Science Advisory Council on "Multi-functionality and sustainability in the European Union's forests" (EASAC 2017), cultural heritage and services are mentioned a few times but not explored much and, overall, the report argued for a "pre-degradation baseline" when assessing biodiversity change. In a review of how legislation and certification of forests influence biodiversity, there were no discussion of values associated with historical cultural influences on biodiversity (Johansson et al. 2013) and the same bypassing of cultural impacts holds for some overviews of so-called "retention forestry" (Gustafsson and Perhans 2010, Gustafsson et al. 2012). In Swedish forestry conservation debates from the 1960s and onwards, aspects of cultural history are generally absent (Simonsson et al. 2015). A recent study of stakeholder's preferences regarding various features of forests, based on questionnaires (Nordén et al. 2017), did not even include any question of cultural values. A general conclusion is that explicit references to cultural values of forests are conspicuous by their absence. Some figures are illustrative. The total area in Sweden of protected grazed forest is ca. 290 hectares (Anonymous 2017b) and of the approximately 100,000 hectares of semi-natural grasslands in Sweden currently receiving subsidies for maintaining grazing management to preserve biological and cultural values, ca. 2% is grazed forest (Swedish Board of Agriculture 2012).

Biological cultural traces in forests

The difference between these two rural landscape components in how historical cultural impacts are perceived, i.e. downgrading forests as cultural landscapes, is not due to a paucity of scientific evidence on forest history. The existence of legacies of pre-modern long-term cultural impact in boreal, boreo-nemoral (Sjörs 1999) and temperate forests in the northern hemisphere is well-known (e.g. Foster 1992, Lindbladh 1999, Rackham 2003, Bradshaw 2004, Hermy and Verheyen 2007, Müllerová et al. 2014, Kirby and Watkins 2015). Vast areas in Europe were historically used as wood pastures (Hartel et al. 2015, Plieninger et al. 2015) and for collection of livestock fodder (e.g. Slotte 2001, Müllerová et al. 2014).

In southern and central Sweden, most area of what is now forest has for long and, until the late 19th to mid-20th centuries, been used for grazing and hay-making (e.g. Slotte 2001, Segerström and Emanuelsson 2002, Brunet et al. 2012, Eriksson and Cousins 2014, Cousins et al. 2015, Kardell 2016). From medieval times, mining became important in parts of southern and central Sweden and had an enormous impact on forests due to the demands for firewood and charcoal (e.g. Emanuelsson and Segerstrom 2002, Angelstam et al. 2013). The wide stretches of forests in the interior of central and northern Sweden also have a long history of human influence. Lindholm et al. (2013) reviewed evidence of numerous archaeological sites in the forested inland of Sweden, related to game pitfalls, village outfield pasture, tar and charcoal production, small mills, hay-meadows and shielings. From around AD 300 and onwards, this part of Sweden was part of integrated trade networks (e.g. Ashby et al. 2015, Lindholm and Ljungkvist 2016) and the collective impact suggests that the forested inland was colonised and utilised from the first centuries AD, much earlier than previously thought. In fact, agriculture may have reached these areas already during the Neolithic and Bronze Age (Josefsson et al. 2014) and, certainly, from the Roman Iron Age, ca. AD 100-500 (e.g. Karlsson et al. 2010). Lindholm et al. (2013) concluded that this cultural landscape has been generally overlooked, both from historical and biological viewpoints. In the northern boreal forest, Sami people practised agriculture, with hay-making, livestock grazing, including reindeer grazing in pine forests, at least from 300-400 years BP (Josefsson et al. 2009, Josefsson et al. 2010a, b, Rautio et al. 2016). During the 16th century, there was a large immigration of Finnish settlers to central Sweden, practising slash-and-burn agriculture and livestock herding (e.g. Linder and Östlund 1998, Wedin 2004). An impact of former land use is evident even in forests that have been considered pristine, e.g. boreal swamp forests (Hörnberg et al. 1998), old spruce forests (Bradshaw and Hannon 1992) and northern boreal forests (Josefsson et al. 2009, Josefsson et al. 2010a).

Furthermore, the difference between these two rural landscape components in how cultural historical impacts are perceived is not due to general differences in recent land use history. Both open and semi-open rural landscapes and forests have been subjected to major land-use change over the last 150 years. From the late 19th century and onwards, the Swedish agricultural and forest landscapes underwent drastic changes

(Antonsson and Jansson 2011, Cousins et al. 2015). In agriculture, a range of new techniques were introduced (Morell 2011), resulting in abandonment of semi-natural meadows, which were transformed into arable fields, forest plantations or were left unmanaged, resulting in a succession towards forest (e.g. Emanuelsson 2009, Brunet et al. 2012, Eriksson and Cousins 2014). Although some meadows were used as pastures, the area of semi-natural grasslands has declined by more than 90% during the last century (Cousins et al. 2007, Cousins and Eriksson 2008, Cousins et al. 2015). Forest grazing was successively abandoned (Steen 1958, Kardell 2016). Initially, old and large trees were selectively harvested (e.g. Linder and Östlund 1998), but clear-cutting was introduced gradually during early 20th century, although selective cutting persisted until the 1950s (Lundmark et al. 2013). In general, this altered management resulted in a great increase in wood biomass and a new (younger) age structure of forests. For example, in an area in the province of Dalarna, estimates suggest an almost six-fold (from ca. 12 m^3/ha to 66 m^3/ha) increase in wood biomass between 1907 and 1989 (Ericsson et al. 2000). Norway spruce became increasingly dominant from the early 20th century (Lindbladh et al. 2014), currently making up 40% of the forest standing volume (Swedish Forest Agency 2015). Today, Sweden is a forested country: 57% of the area is productive forest, 12% is unproductive forest and 6% is other wooded land (Swedish Forest Agency 2015).

Overall, these changes reflect the transformation of Sweden from a mainly agricultural to an industrialised country. Some figures are presented to illustrate this change as follows: between the 1870s and the 1940s, the fraction of Swedish BNP coming from agriculture dropped from 40% to 10%, the number of crofters dropped from 100,000 to a few thousand and, while the number of farms remained more or less constant until the 1940s, this number declined drastically after the Second World War (Morell 2011). As discussed further below, these changes are associated with new perceptions for cultural values in forests.

The most general human impact on forests before this modernisation was through grazing by livestock, collection of hay at sites where this was suitable, selective use of wood and altered fire regimes (e.g. by slash-and-burn cultivation). This created an increased openness, promoting development of stands of old trees, particularly Scots pine, with a field layer of grasses and herbs (e.g. Segerström and Emanuelsson 2002, Josefsson et al. 2009). Close to settlements, the effects also included nutrient dynamics, soil compaction and increased microbial decomposer activity (Freschet et al. 2014). As stated by Ericsson et al. (2000, page 235): "This grazed forest with large Scots pines, grass and herbaceous plants constitute a landscape almost unknown today…".

However, although old-fashioned ways of using forest do not exist anymore, the biological cultural traces have not gone. These legacies may refer to occurrences of deciduous forest stands in boreo-nemoral and boreal regions (e.g. Björsne and Bradshaw 1998, Hellberg et al. 2003), remaining patterns of species distribution (e.g. Lindbladh et al. 2000, Segerström and Emanuelsson 2002, Östlund et al. 2015) and culturally modified trees. Trees with traces of ringbarking, production of axe-handles, boundary marks and trees for magic use are abundant in northern Sweden (Östlund et al. 2002,

Rautio et al. 2014). Some trees bear written messages, a kind of forest notice board (Andersson et al. 2005). Many plant species may persist as slowly declining populations over quite long time. In grassland systems, time lags in the order of a century have been documented (Lindborg and Eriksson 2004, Helm et al. 2006) and legacies of previous grassland management in what is currently forest and maintained over a century, have been documented (Herben et al. 2006, Johansson et al. 2011). These legacies may also remain after one forest-cycle of clear-cutting (Jonason et al. 2016). Very few similar studies have been conducted in forest systems and focusing on what is regarded as forest species, perhaps due to a preconceived notion that such legacies are not expected when research is conducted in forests. Suggested examples of species reflecting previous cultural impacts in forests include plants such as *Actaea spicata*, *Lathyrus vernus*, *Galium odoratum* and *Festuca altissima* (Nilsson et al. 2001), *Lycopodium complanatum* (Oinonen 1967b) and *Chimaphila umbellata* (Lundell et al. 2015), lichens such as *Lobaria* spp. (Nilsson et al. 2001) and *Usnea longissima* (Josefsson et al. 2005), wood-dependent beetles (Lindbladh et al. 2003) and birds such as *Dendrocopos minor* (Lesser spotted woodpecker) (Wiktander et al. 2001) and *Caprimulgis europaeus* (Nightjar), *Lullula arborea* (Wood lark) and *Dryocopus martinus* (Black woodpecker) (Linder and Östlund 1998). Despite these suggested examples, there is a general paucity of studies of historical land-use effects for species of plants and animals in forests, as compared to semi-natural grasslands (cf. Eriksson and Cousins 2014).

Thus, there is no doubt that forests in Sweden are indeed a historical cultural landscape and that there are abundant legacies of previous management. Modern forestry has not eroded all biological cultural traces emanating from the time before modernisation.

I suggest that there are two main reasons why BCH is generally over-looked in forests; loss of cultural memory and the dominance of a perception of forests as wilderness. In the following sections, I discuss these in some more detail.

Loss of cultural memory

Cultural memory (synonymous to "social memory", Connerton 1989) is a concept used in various contexts within the social sciences (e.g. Hirsch and Smith 2002, Terry 2013). According to Connerton (1989, page 37), social memory works when "groups provide individuals with frameworks within which their memories are localized (…) mental spaces provided by the group (…) these mental spaces (…) always receive support from and refer back to the material spaces that particular groups occupy." Laland and Rendell (2013) suggested that cultural memory is a general feature of humans, based on knowledge transmission, learning and copying. Furthermore, they considered cultural memory as adaptive for coping with changing environments. This is in line with a definition of culture as "information that is acquired from other individuals via social transmission mechanisms such as imitation, teaching, or language" (Mesoudi 2011, page 2). An example of the association between cultural memory and material manifestations of culture is the common understanding that in pre-literate societies,

material features of whole landscapes such as settlements with their surrounding resource base (crop fields, pastures etc.), graves and ceremonial sites were organised to represent people's perceptions of cosmology and religion, their 'world view' (e.g. Hodder 1990, Tilley 1994, Kristiansen and Larsson 2005, page 357 ff., Andrén 2014).

It may seem far-fetched to envisage anything similar in a modern society. However, the discourse on perceptions of heritage, as founded by knowledge and memory of landscape history, identity and sense of place and the meaning people attribute to material remains of history (e.g. Schama 1995, Antrop 2005, Taylor and Lennon 2011, Braaksma et al. 2016), in a way reflects a similar role of landscapes for people today. By "knowing the landscape", people may experience home and identity. Knowing the historical background of places or features of landscapes promotes such feelings, respect for previous generations and it stimulates an active interest in maintaining features regarded as traditional. Consider a farmer who is managing a semi-natural grassland previously managed over many generations. By doing this, the farmer maintains a cultural memory of management history and this cultural memory adds to the perceived heritage value of that particular grassland. This example illustrates cultural memory founded on ongoing activity. Indeed, studies of people's valuation of agricultural rural landscapes suggest not only that a cultural memory promotes perceptions of heritage values, but also that such a cultural memory partly depends on the current utility of these landscape elements (e.g. Stenseke 2006, 2009, Braaksma et al. 2016).

Although the loss of biological and cultural values due to drastic landscape changes was subject to debate in Sweden from the 1930s and onwards, it was not until the 1980s when a national survey of semi-natural grasslands was initiated (Swedish Environmental Protection Agency 1987). Such national programmes for preserving BCH in agricultural landscapes play an important role for promoting a societal cultural memory. These programmes represent what Smith (2006) termed an "authorized heritage discourse", i.e. "… aesthetically pleasing material objects, sites, places and/or landscapes that current generations 'must' care for, protect and revere so that they may be passed to (…) future generations (…) to forge a sense of common identity based on the past" (Smith 2006, page 29). In addition, a societal cultural memory also depends on perceptions of people who are not themselves directly close to the material cultural manifestation (for example, they live in cities and have their main experience of the rural agricultural landscapes from books and television or perhaps from short visits during holidays). Thus, popular culture plays a role. For example, the Swedish author of children's books, Astrid Lindgren (e.g. 'The six Bullerby Children', 'Emil of Lönneberga') has probably meant a lot for Swedish people's appreciation of old-fashioned rural agricultural landscapes and for maintaining a cultural memory even amongst those lacking direct experience of such landscapes.

In contrast, forested landscapes fall outside this authorised cultural heritage discourse (e.g. Svensson et al. 2018). The separation of agriculture from forest management during the 20th century (mainly by abandonment of forest grazing and haymaking on wetlands) initiated a loss of cultural memory of forests as old cultural landscapes. Forests became an object for the forestry industry. Rural people's livelihood did

not depend on forests as previously. There were few people transmitting memory of previous cultural practices in forests. In fact, from the 1950s, a large fraction of people, living in agricultural regions outside the most agriculturally productive plains, left for other jobs in the industry (Morell 2011). A similar separation holds for industry historically dependent on forests. It is illustrative that some of the industrial remains of the mining landscapes in Sweden are protected as UNESCO World Heritage (The Mining Area of the Great Copper Mountain in Falun and the Engelsberg Ironworks), but not the forest landscape that was an essential basis for the industry.

Thus, the divorce between agriculture and forests that commenced during late 19th century and was, more or less, completed in the 1950s, resulted in a general loss of cultural memory regarding forests. This loss of cultural memory concerned people living in the rural landscapes as well as authorities concerned with management and conservation. In contrast, a cultural memory was maintained in agriculture, implying that remains of old and traditionally managed grasslands were perceived as cultural heritage and their biological features thus as BCH.

Instead of being viewed as cultural heritage, conservation efforts in forests focused on protecting wilderness, which was seen as not (yet) exploited by the forestry industry. This leads to the other main issue influencing why BCH is over-looked in forests, how wilderness is understood and perceived.

Perceptions of wilderness

There is extensive literature on the history of the conceptual divide between culture and nature (e.g. Williams 1980, Worster 1994, Haila 2000, Kricher 2009). Here it may suffice to remark that, during the Enlightenment (late 1600s - 1700s), a view developed where nature was represented as an object of exploitation and investigation, inspired by a Cartesian idea of the world as a machine (Haila 2000, Outram 2013). For example, Williams (1980) suggested that the conceptual separation of culture vs. nature was a result of the identification of humans as free to investigate and make experiments on nature. During the late 1700s and especially during the following century, a critical reaction emerged to what was regarded as a destructive human dominance over nature. This was a feature of what has been termed "Romanticism", which promoted a view that nature represents something not artificial, authentic, uncorrupted and good, as a state opposed to civilisation (Outram 2013).

One such influential author was the explorer and naturalist Alexander von Humboldt, whose books were widely read (e.g. *Ansichten der Nature*, in English translation *Views of Nature*, von Humboldt (2014 [1808]). Von Humboldt had an impact on the development of an early green movement (e.g. Henry David Thoreau) and on the proponents for establishing National Parks in the United States, such as John Muir (Wulf 2015). During late 19th century, ideas of national heritage also developed in many other countries along with an ambition to consolidate national identification (e.g. Schama 1995, Smith 2006, Graham and Howard 2008). Natural (and cultural)

heritage became a "thing" that was conceptually possible to preserve, to freeze in a certain state (Olwig 1984). In Sweden, the first National Parks were established 1909. The underlying idea was to preserve wild nature, considered as representing what was seen as characteristic for Sweden as a nation (e.g. Mels 1999).

The National Parks in Sweden also included areas that were strongly influenced by management. An example of this is Ängsö, an island north of Stockholm, composed of open pastures and semi-open wooded meadows. This vegetation was initially interpreted as remnants of old virgin deciduous woodland. As nature protection prescribed free development, excluding human intervention, the wooded meadows at Ängsö soon encroached and the original beauty deteriorated. During the following decades and after a debate amongst conservationists, management was reintroduced at Ängsö in the 1940s. Using the concept suggested in this paper, one could say that BCH was finally recognised. However, although several early conservationists argued that, not only the still managed agricultural landscape, but also forests should be seen as products of culture (thus being BCH), nature conservation was henceforth mostly concerned with wilderness (this debate is described in Gren (2010) and Wijkander (2017), both being only available in Swedish).

An idea underlying the early movement to protect nature was that human intervention in nature is fundamentally destructive and that wilderness (the object of preservation) is not compatible with cultural impacts. This is still a common opinion. As succinctly stated by Stokes (2018, page 2): "This idea of wilderness as antidote to civilization serves as a central organizing principle of the modern conservation movement (…)." Questioning the existence of wilderness would then be seen as threatening the whole idea of nature conservation. As illustrated by the debate following a controversial paper by Cronon (1996), where he argued that wilderness is a human social construct, there is much confusion associated with the wilderness concept (Proctor 1998). The question of how wilderness is conceptually understood should not be confused with the issue of whether those presumed wilderness-areas really are untouched by humans. The issue is not whether nature is or is not, truly pristine (most vegetation is not, e.g. Willis et al. 2004), but rather if and when an idea of a wilderness is projected on nature and in what sense such a projection implies certain values and actions. Cronon was thus misinterpreted, as if he had claimed that wild nature *per se* does not exist. This was of course not the point. Very few, if any, hard-core social constructivists would claim that. It is the concept of wilderness that is a social construct, not the physical objects that build up nature (e.g. mountains, forests, species). The conceptual relationship between culture and nature is still underlying controversies revolving around the so-called "new conservation science" (Marris 2011, Kareiva and Marvier 2012, Doak et al. 2014, Wuerthner et al. 2014), although some authors argue that these contrasting opinions may quite easily be reconciled (e.g. Mace 2014).

It is thus argued that the association of nature worthy of protection with the concept wilderness, understood as nature where there has been no cultural impact, has contributed to inhibit recognition of BCH in forests, i.e. created a kind of blind spot for forests as cultural landscapes. While rural agricultural landscapes escaped the con-

ception of wilderness, but remained being valued as cultural landscapes and also valued for the biological diversity, conservation of forests still maintained the original 19th century focus on what was perceived as wilderness.

Discussion

The growing interest in conservation of cultural landscapes reflects the fact that many old cultural landscapes are threatened, but also an awareness that cultural landscapes may be biologically rich. In a world of ever increasing human dominance, it is important to gain knowledge of how this biological richness has developed and could be maintained. Along with this interest, there is also an ambition to promote integration between research and programmes for cultural and natural heritage (Gillson and Willis 2004, Swedish National Heritage Board 2014, Anonymous 2017a, Crumley et al. 2018). For too long, these two fields have been separated in both academia and institutions, such a governmental authorities responsible for organising and managing heritage (including biological diversity). An important step to achieve such integration is to agree on concepts used in communication and research (e.g. Eriksson et al. 2018). I suggest that the proposed definition of biological cultural heritage (biological manifestations of culture, reflecting indirect or intentional effects or domesticated landscapes, resulting from historical human niche construction) will be helpful to promote such integration and a research agenda for studies of biological cultural heritage in general and thus to guide management programmes in cultural landscapes. This definition identifies different forms of relationship between biological features and culture, arranged in a gradient of increasing intensity of interactions between the focal biological features and culture. The concept of domesticated landscapes formed by niche construction provides a theoretical framework for identifying mechanisms behind interactions between culture and biological features (e.g. Laland and O'Brien 2012, Eriksson et al. 2018), interactions that are embedded in complex networks, entanglements (Hodder 2012, Eriksson and Arnell 2017) or "biodiversification" (Cevasco et al. 2015).

The second objective of this paper was to try to identify factors influencing when and why biological cultural heritage is recognised. The method was to compare two components of rural landscapes in Sweden, open and semi-open landscapes and forested landscapes, which differ in the way they are perceived as cultural landscapes.

The starting-point was that biological cultural heritage is generally over-looked in forests. I suggest that there are two main factors responsible for this. Firstly, recognition and valuation as heritage depends on social context, specifically relating to current activities by people, people's perceptions of identity and sense of place, knowledge of history and a cultural memory both amongst people in general and amongst authorities. Concerning forests, there has been a loss of cultural memory (both locally and amongst authorities). This illustrates that recognising biological cultural heritage does

not rely only on the biological features *per se* or on scientific knowledge of their historical background. Despite a solid scientific knowledge of the history of forest landscapes, biological cultural heritage is nevertheless over-looked. Secondly, basic assumptions and perceptions of a culture vs. nature divide, that emanated during the 19th century as a part of Romanticism have had and still have, a pervasive influence on perceptions and valuation of forests. Together, these two factors contribute to create a blind spot for cultural heritage in forests.

What are the implications of this conclusion? Why should we care about biological cultural heritage in forests? After all, if, as several authors claim, the meaning and value people assign to material manifestations of culture are constantly changing and renegotiated in the current society (e.g. Hobsbawn 1983, Smith 2006, Graham and Howard 2008), i.e. heritage is a social construction, is not the loss of cultural memory regarding forests just a reflection of such a renegotiation? In the current society, forests are either managed for industrial production or, as a recent addition to management objectives, climate change mitigation (e.g. EASAC 2017) or for conservation of biodiversity. With the latter aim in mind, the perception of forests as wilderness may perhaps work perfectly well.

I think there is a two-part answer to the question why we ought to care about biological cultural heritage in forests. The first part of the answer is "philosophical" and the second is pragmatic.

The discourse on how to value heritage revolves around the question of value relativism, i.e. whether there is or is not, an absolute point of reference or frame, for assessing value to tangible and intangible manifestations of culture. In the context of biological conservation, such a reference point is usually termed a baseline. Some argue that there are such baselines and one obvious choice would be untouched nature. For example, according to EASAC (2017), the pre-degradation state (note the negative connotation in the choice of term) of forests is such a baseline, suggested to be independent of societal values. This idea is also underlying arguments that conservation biology should prioritise preserving wilderness over conservation of cultural landscapes (e.g. Wuerthner et al. 2014). Others argue that baselines are always socially constructed (e.g. Hilding-Rydevik et al. 2018). The latter argument seemingly fits, on scientific grounds, into the reasonable conclusion that the forests we discuss here are indeed historical cultural landscapes and that the untouched state does not exist anymore. The view that baselines are social constructs may seem to imply that what we chose as a baseline would be principally arbitrary. Some conservationists have expressed worries for using this way of handling baselines, the "shifting baseline syndrome", i.e. when human perceptions of change guide conservation management (Pauly 1995, Papworth et al. 2009).

However, as remarked above, by referring to papers by Cronon (1996) and Proctor (1998), I would argue that the discussion on social construction in relation to biological features is somewhat confused. While the understanding and meaning we

project on biological objects and features (such as a forest, a wooded meadow or a species) may well be socially constructed, these objects and features as such are, of course, objectively real. A reflection is that a focus on species instead of whole communities and ecosystems would alleviate the problems associated with whether nature as a whole is untouched or not. Most species are untouched in the sense of not being domesticated. Then it becomes an empirical question whether a focal species (or a group of species) has been favoured by or even dependent on historical cultural impacts. If this is the case, elements of cultural landscapes, for example a wood pasture or a wooded meadow, also represent a baseline that is not arbitrary.

This leads over to the second, pragmatic, part of the answer to the question why we ought to care about biological cultural heritage, namely that a multitude of biological features and objects in forests, including many species, actually were favoured by and even dependent on the historical cultural landscape (e.g. Björsne and Bradshaw 1998, Josefsson et al. 2009, Rotherham 2015, Agnoletti and Santoro 2015, Whitlock et al. 2017, references above in the Section "Biological cultural traces in forests"). In other words, these features and objects reflect the processes included in the definition of biological cultural heritage, indirect and intentional effects and historic landscape domestication, driven by human niche construction. Thus, conservation management of forests needs to incorporate knowledge of cultural history and this necessitates that biological cultural heritage in forests is recognised. As remarked earlier in this paper, research on species as historical cultural legacies in forests is a particularly neglected research field.

A recognition of biological cultural heritage is thus important irrespective of whether the conservation goal is to focus on culturally impacted forests or to try identifying what is considered as (or close to) a pristine state of forests (e.g. Samojlik et al. 2016). There is no inherent conflict between preserving relatively untouched forests and those with remaining traces of pre-industrial forest management. Consequently, even if it is true that biological cultural heritage is over-looked in forests, this does not imply that it is "wrong" to protect forests that have not yet been exploited by modern forestry. Given the current state for many threatened species, this may be highly motivated (e.g. Nilsson et al. 2001, Johansson et al. 2013).

In conclusion, it is argued that removing the blind spot for cultural history is essential for guiding development of both cultural and biological conservation programmes in forests. The notion of a blind spot for cultural history of forests should not be understood as criticism of the ambition to increase the forest area protected from modern forestry. However, it implies that features of previously culturally impacted forests should be recognised, for example, in restoration programmes. Furthermore, recognising and appreciating biological cultural heritage in forests will promote interest and learning of the history of forests and their values and will be informative for developing sustainable conservation programmes for all biota in forests, not only those that historically were favoured by culture. Finally, recognition of biological cultural heritage in forests will inspire and promote further integration of cultural and natural heritage research.

Acknowledgements

I am grateful to the organisers of the conference 'Forests: Diversity of Natural and Cultural Heritage' (SKÅNK) in Uppsala, October 3-5, 2017, where this paper was presented and to J. Ehrlén, K. Hylander, K.-J. Lindholm, I. Rotherham, J. Tzanopoulos and M. Santaoja for comments on the manuscript. This paper is a contribution from the project "Contesting marginality: The boreal forest of inland Scandinavia and the worlds outside, AD-1500 AD", supported by the Swedish Research Council.

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